Seasonality and Other Components of the Irish Unemployment Series

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SEASONALITY AND OTHER COMPONENTS IN THE IRISH UNEMPLOYMENT SERIES

by

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1. Introduction and Summary

This paper examines methods of seasonally adjusting economic time series; in particular, it examines the methods of estimating the seasonal and other time series components of unemployment in Ireland. Thus, while the results of this analysis may have implications for other time series, the study's main aim is the adjustment of the unemployment data. It should be emphasised that a univariate analysis is being carried out here and the optimal method of seasonal adjustment could be much different in the case of a multivariate approach — Wallis (1976). The results shed some light on the question of whether the series contains an additive multiplicative or mixed seasonal element — Dowling (1975) and Bradley (1977). It also agrees with the recommendations made in the Report of the Interdepartmental Study Group on Unemployment Statistics (ISGU) (1979) that a seasonally adjusted series of Live Register figures be compiled and published. However, the most satisfactory method of seasonal adjustment leads to the rejection of another of the group's recommendations: that the frequency of publication of the present weekly Live Register statement should be reduced to a monthly basis.

At present, there are several different organisations involved in the derivation of seasonal factors for unemployment in Ireland[1]. It has been noticed that different seasonal factors are being produced by the different institutions and this has led to confusion. The reasons why different institutions produce different data can be divided into two broad classes. First, the definitions of the raw data fed into the seasonal factor estimation routine may differ and, secondly, the estimation routines may differ. This paper attempts to arrive at a more definitive set of seasonal factors for unemployment, given the present state of knowledge in the science of seasonal factor estimation.

To do this, the raw data fed into the seasonal factor estimation routine has to be decided upon. This is done in section 2 of this paper.

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Section 3 then proceeds to describe two seasonal adjustment routines. Two computer routines are investigated for this purpose. One is the United States Bureau of the Census XII programme (XII method) — this method is described in section 3.1. — and the other is the recently developed British Central Statistics office computer programme (BCSO method) — described in section 3.2. The computer programmes to implement these methods are picked because they are among the most advanced programmes available, and have contrasting styles[2] of seasonal factor estimation. The programmes are then compared in section 4 with a view to picking the better programme.

The seasonal factors and other components of the time series finally estimated from the preferred programme are shown in section 5. There is then a short discussion of these results. Finally, section 6 comes up with some conclusions.

2. The Raw Data to be used in the Estimation Routine

Depending on the time period used, different factors will be estimated. The data period used in this analysis is January 1967 to May 1978. There were several reasons for picking this time period, among them being:

(a) The definition of unemployment on the live register changed radically from January 1967 and, following on this,

(b) It was felt that the longer the time period for analysis, the better.

Several institutional changes cause discontinuities in the data in this period (e.g. Employment Period Orders and the lowering of the pension age). Unless these discontinuities are corrected, biassed estimates of the seasonal and other components of the time series will be obtained. Details of the adjustments made are available on request from the authors.

Unemployment is defined as being the total number of people signing on the live register. These can be broken into three main categories — a) Unemployment Benefit Recipients (UB), b) Unemployment Assistance Recipients (UA) and c) other people signing on the live register who do not qualify for Unemployment Benefit and Unemployment Assistance (UO). It has been found that the seasonality in each category is quite distinct; therefore, better estimates of overall seasonality are obtained by estimating the seasonality in each different category separately.

Finally, on the data definition side, it was necessary to decide on what was to represent the monthly figure. In the case of all organisations (mentioned on page 37), one day in the month was picked as being representative (of the month). In most cases, the end-month figure was used. In the case of one, mid-month figures were chosen. The mid-month figures produced a pattern of seasonality for unemployment which differed from the

2. The XII method uses a moving average technique to estimate all of its components while the BCSO method uses a regression technique to derive the final seasonal factors.

end-month figures. On reflection, it was considered that if the seasonality representative of the month were required then the average weekly figures would be the best ones to use on a priori grounds. However, to extract average weekly figures would cause an extra amount of work every month and it was also contrary to the proposal in the ISGU to publish an end-month figure only. A preliminary analysis of the data indicates a big difference between the seasonality produced by the average weekly and that produced by the end-month data — no matter which programme is used. Therefore, it was decided to use average weekly for the rest of the analysis.

In summary, then, the data which will be fed into the seasonal adjustment routines to check which is the better will be: The average weekly figures for the months January 1967 to May 1978. The data is corrected for discontinuities due to institutional and other changes during the period. The details of these corrections are available on request. Three separate series will be analysed — UB, UA and UO and the seasonality of total unemployment on the live register will be obtained by adding together the estimated seasonal factors of each component.

3. Description of the XII and the BCSO Methods of Seasonal Adjustment

This section is divided into two sub-sections. Sub-section 3.1 first describes the XII method of seasonal adjustment and then the BCSO method is described in sub-section 3.2.

3.1 *A Description of the XII Method of Seasonal Adjustment*

The XII programme assumes that any time series Z_t can be represented by three components: a trend cycle (T_t), a seasonal (S_t) and an irregular component (I_t). The relationship between Z_t and T_t, S_t and I_t could be multiplicative;

$$Z_t = T_t \times S_t \times I_t = \xi_t (1 + \beta_t) \epsilon_t \qquad \text{..................} \quad (1)$$

or additive;

$$Z_t = T_t + S_t + I_t = \xi_t + \alpha_t + \epsilon_t \qquad \text{..................} \quad (2)$$

(i.e., $T = \xi$; $S = 1 + \beta$, when multiplicative, $S = \alpha$ when additive; and $I = \epsilon$).

The programme has the option of picking either of these models. The following is a summary — reproduced from Burman (1965) — of the main steps through which the XII programme works to estimate the components (T, S and I) of any time series.

Summary of Main Steps through which the XII Programme Proceeds

1. Form centred 12 month moving average of observations (i.e., 2-term average of 12-term average, so that it is centred on the middle of the months). This is a preliminary estimate of ξ_t.
2. Divide (subtract) moving average into (from) the observations to obtain monthly ratios (values). This provides a preliminary estimate of $(1 + \beta_t).\epsilon_t$ for a multiplicative model (and $a_t + \epsilon_t$ for the additive).
3. Identify and replace "extreme ratios"*. There are six missing ratios at each end, due to use of 12-month moving average. These are replaced by repeating first or last available ratios for these months.
4. Normalise for 12 ratios for each year, i.e., divide them by their arithmetic mean so that they add to 1.0.
5. Compute (3) x (3) moving average of ratios for the same month over successive years; missing values at the end of the series are replaced by adding two extra ratios equal to the mean of the last two; a similar procedure is used at the beginning of the series. These averages are the preliminary monthly seasonal factors (M.S.F.), i.e., preliminary estimates of $(1 + \beta_t)$ or a_t.
6. Divide (subtract) preliminary M.S.F. into (from) original observations to obtain preliminary adjusted series — a preliminary estimate of $\xi_t \cdot \epsilon_t$ (or $\xi_t + \epsilon_t$).
7. Form 15-month moving average (Spencer's formula — Spencer 1904) of adjusted series. To avoid loss of trend at end of series extrapolate 7 extra terms by the average of last 4 terms of adjusted series — treat beginning of series similarly — this provides an improved estimate of ξ_t.
8. Divide preliminary adjusted series by its moving average to obtain "irregular ratios". This gives preliminary estimates ϵ_t. Mean of absolute first differences of these (called d) gives a measure of the irregularity of the series.
9. Repeat steps 2-4. (The moving average used is that calculated in 7.)
10. Compute (3) x (3) or (3) x (5) moving average of ratios for each month — the choice depending on whether d $<$ 2 per cent. of d $\geqslant$ 2 per cent.; extrapolate end averages as before. These are the final M.S.F. These give final estimates of $(1 + \beta_t)$ or a_t.
11. Divide the final M.S.F. into original observations to obtain final adjusted series. This gives final estimates of $\xi_t \cdot \epsilon_t$ or $\xi_t + \epsilon_t$.
12. Extrapolate the final M.S.F.s for the next year thus: factors for latest year plus half the difference between the latest factors and those for the previous year.

* The method of replacing extreme values of monthly ratios depends on estimating the standard error for each month on the deviation of the ratios from their 5-term moving average.

3.2 *The BCSO Method of Seasonal Adjustment*

Because of the possibility that seasonality could be of a mixed nature, including a multiplicative part ($\xi_t (1 + \beta_t) \epsilon_t$)

and an additive part ($\xi_t + \alpha_t + \epsilon_t$),

the British CSO postulated the model:

$$Z_t = \xi_t + \alpha_t + \beta_t \xi_t + \epsilon_t \quad \text{.........................} \quad (3)$$

In the case of monthly series we could set:

t = 12(i — 1) + j where i = 1, 2, ... N are the years
and j = 1, 2, ... 12 are the months

The model can then be re-written:

$$Z_{ij} = \xi_{ij} + \alpha_j + \beta_j \xi_{ij} + \epsilon_{ij} \quad \text{.........................} \quad (3a)$$

(The subscript i can be dropped from a_{ij} since $a_{ij} = a_{i+k,j}$ for all i, k)

The following is a summary of the steps through which the BCSO programme works (Durbin and Murphy, 1975).

Summary of Steps through which BCSO Programme Works

1. A moving average of the series is first obtained and this is taken as the estimated trend — X_{ij}[3].
2. The a_j and β_j and irregular (ϵ_{ij}) are estimated using the following regression

$$Z_{ij} - X_{ij} = a_j + b_j X_{ij} + r_{ij} \quad \text{.....................} \quad (4)$$

   It has been found (Durbin and Murphy) that the r_{ij} have properties which render the parameters of the model: $(Z_{ij} - X_{ij}) = a_j + b_j X_{ij} + r_{ij}$, suitable for estimation by regression methods.
3. Once the trend is estimated and estimates of a_j, β_j are obtained ($\hat{a}_j$ and $\hat{b}_j$ respectively) from equation (4) by means of a stepwise regression procedure on the fourier transform of Z_{ij}, the series is then deseasonalised by $\dfrac{Z_{ij} - \hat{a}_j}{1 + \hat{b}_j} = X_{ij} + \hat{r}_{ij}$.
4. A thirteen point Burman moving average of $X_{ij} + \hat{r}_{ij}$ (having desirable characteristics, Burman (1965)) — is obtained in order to improve the estimate of the trend.

3. The moving average used to estimate X_{ij} is a 21 point moving average. This moving average has very desirable characteristics (as opposed to the characteristics of the outlined 12 month moving average used by the XII method) which are described in Murphy (1973a). In summary, it assumes (in estimating this trend) that the data contain seasonal, where parameters are changing over time, elements which can be represented by a linear combination of sines and cosines of seasonal period.

5. This improved estimate of the trend $(X_{ij}^{(1)})$ is then slotted into equation (4) to obtain an improved equation

$$(Z_{ij} - X_{ij}^{(1)}) = a_j^{(1)} + b_j^{(1)} X_{ij}^{(1)} + r_{ij}^{(1)}$$

and thus improved estimates of α_j and β_j are obtained. This procedure is repeated iteratively until stable estimates emerge.

These steps are basic to the British C.S.O. model. However, additional options have been added to allow the model conform more with actual data. The following are the main options.

(a) *Taking Care of Moving Seasonality*

It is a noted phenomenon in economic time series that the seasonal element for a particular month does not remain constant through time. The British C.S.O. has devised three procedures which takes account of this moving seasonality.

(i) The first procedure is to estimate the parameters α_j and β_j using n years data at a time. A typical value for n used is seven;

(ii) An additional two parameters can be added to the model to revise it to the following form:

$$Z_{ij} - \xi_{ij} = \alpha_j^{(o)} + \alpha_j^{(1)}(i) + \alpha_j^{(2)}(i^2) + \beta_j \xi_{ij} + \epsilon_{ij} \quad \ldots\ldots (5)$$

This means that the additive factors for a particular month can be fitted to a polymonial in i of degree two or less. This allows for a trend in the seasonal factors.

(iii) The phenomenon of the seasonal *pattern* remaining constant while the importance of seasonality (measured by its amplitude — see figure 1 below) increases or decreases over short periods of time, prompted the British C.S.O. to introduce the concept of a local amplitude scaling factor — Durbin and Murphy (1975).

The model was thus extended as follows:

$$Z_{ij} - \xi_{ij} = \delta_{ij}(\alpha_j^{(o)} + \alpha_j^{(1)}(i) + \alpha_j^{(2)}(i^2) + \beta_j \xi_{ij}) + \epsilon_{ij} \quad \ldots\ldots (6)$$

where the δ_{ij} is estimated over periods of fifteen months at a time.

(b) *Taking Care of Extreme Values:*

The residuals in the first regression fit are examined to see if they lie outside the range of $\pm k_1 s$ where k_1 is a constant which can be picked by the user — the value used is usually 2. The letter 's' stands for the standard error of the regression. Residuals between $\pm k_1 s \pm k_2 s$ ($k_2 = 3.75$ usually) are adjusted linearly so that $\pm k_2 s$ values lie on the regression plane. Values

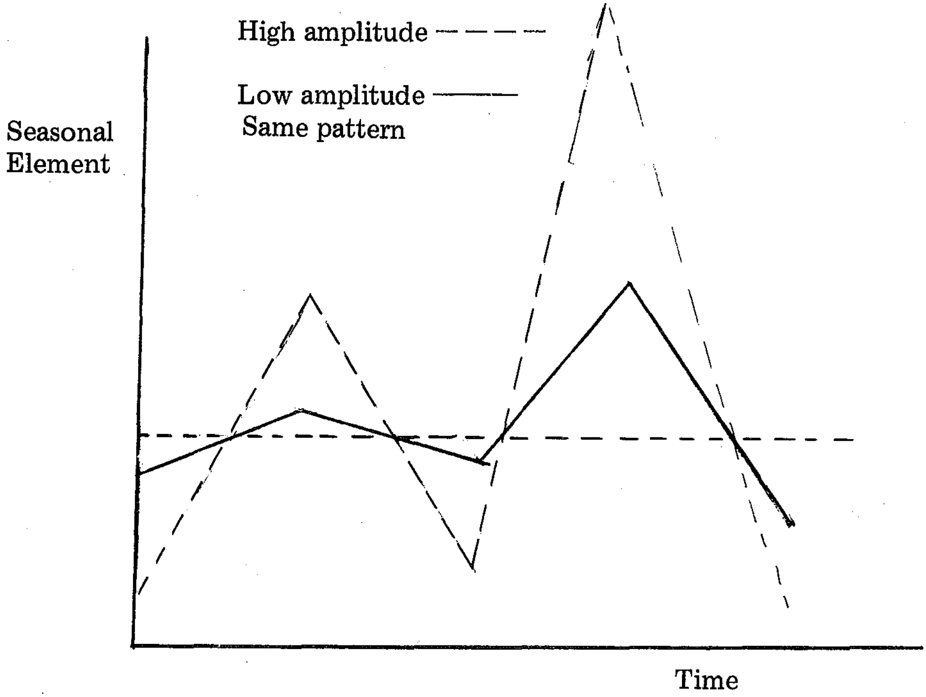


Figure 1: Illustration of how the pattern remains the same but the amplitude increases.

greater than $\pm$ k_2s are also assumed to lie on the regression plane. The problem of the s being calculated including the $\geqslant k_2s$ value is also tackled by the BCSO. The method is complicated and can be examined in more detail in Murphy (1973 a). One special feature of the treatment of extremes which should be mentioned is that if an extreme occurs in a month which had an extreme the year before neither extreme is modified.

(c) *Estimating Seasonally Adjusted Data for End Values:*

Six values are lost at the start and the end of the series because of the estimation of the trend by a thirteen term Burman moving average. A preliminary seasonally adjusted series can be obtained for these last six observations using seasonal factors estimated from the previous regression base. A straight line trend is fitted to these seasonally adjusted series in order to obtain estimates of the trend of the last six values. A different procedure is then used to correct for extreme values for these six observations and the method is set out in Murphy (1973 b).

(d) *Adjusting for the Trend outside the Regression Base:*

The values for a_j and β_j are calculated using a regression base which is six months out of date. Also one might want to use the seasonal factors one year ahead. Because the trend outside what is called the regression base may be much different to that inside the base, a further correction is made to the factors. This is set out in Murphy (1973 b).

4. Comparison of the XII and BCSO Methods of Seasonal Adjustment

This section first compares the XII and the BCSO methods of seasonal adjustment on a theoretical basis — this is done in sub-section 4.1. Sub-section 4.2 then compares the empirical results obtained from both programmes. It is necessary to compare the results on an empirical as well as a theoretical basis for the following reasons:

(a) Both methods of seasonal adjustment are iterative;
(b) The models underlying both methods differ;
(c) It is unlikely that the model underlying unemployment follows either the BCSO or the XII models exactly; and
(d) It is not the purpose of this exercise to develop a computer programme tailor-made for Irish unemployment data.

It is necessary to develop some model free criteria — to see which computer package should be used in future — this is done in 4.2.1. The derivation of the time series components for the unemployment data is then discussed in 4.2.2. Finally, using the criteria in 4.2.1. and estimates from 4.2.2., the results are compared in 4.2.3.

4.1. *Theoretical Comparison of the XII and BCSO Methods of Seasonal Adjustment*

Burman outlines the criticisms levelled against the XII method. The main ones are:

(i) If the model is multiplicative, it seems illogical to take arithmetic instead of geometric means in 1, 5, 7 and 10 in table 2. This first criticism does not really apply to seasonally adjusting the unemployment series since the additive model is used for UB and UA — the bulk of total unemployed on the live register.

(ii) The centred 12-month moving average suppresses the seasonality completely but is too inflexible in measuring the trend; even though an iterative procedure is adopted, Hannan (1963) shows that convergence could be slow and the XII method could leave considerable bias in the estimates.

(iii) In the case of slowly moving seasonality, the moving averages in steps 5 and 10 are likely to be too much influenced by local irregularities. This may lead to large revisions when more data become available.

(iv) The method of extrapolation to steps 3, 5, 10 and 12 is too rigid. It should depend on more (or fewer) of the recent M.S.F. depending on the strong (or weak) a part the irregular plays.

(v) The decision about which month ratios are "extreme" is based on the short series of years for each month. The value of $2\hat{\sigma}$ in such small samples must be very dubious. ($100 \pm 2\hat{\sigma}$ is the interval outside which extremes SI ratios are replaced — $\hat{\sigma}$ is the estimated standard error of the SI ratio. It is found in practice that quite small revisions to previous data have a marked effect on the decision as to whether data is extreme or not.)

(vi) The method of extrapolating the trend in step 7 is extremely crude and can lead in practice to an overweighting of the influence of the last four terms in assessing the latest seasonal pattern.

(vii) The XII programme is inclined not alone to adjust for seasonality but also to adjust data for other cyclical behaviour of a non-seasonal type.

It is because of these criticisms and also because the XII programme did not take account of mixed seasonality, that the British C.S.O. developed a programme of their own. It was considered that the improvement of the moving averages in the BCSO programme (replacing the central 12-month moving average and the Spencer 15-point formula by Burman's formula) criticism (ii) of the XII programme was met. By the more sophisticated method of replacing missing values it was hoped that criticisms (iv) and (vi) would be met. The BCSO method of replacing extreme values hoped to meet criticism (v).

There is no doubt about the theoretical merits of replacing the crude moving averages and methods of replacing missing and extreme values. However, criticisms (iii) and (vii) have still to be met. In the case of criticism (iii), it is questionable if the regression method of estimating the seasonal factors and scaling these factors by a local amplitude will make the estimates of moving seasonality — an accepted phenomenon in time series — any more stable. If anything, the shortness of the period taken to estimate a local amplitude scaling factor would cause the estimate to be much more influenced by local irregularities. Also the statistical tests used to accept or reject the hypothesis of trend in the additive component of the seasonal factor leave a lot to judgement. The small number of observations available to estimate this trend line in the additive factors is likely to cause the parameters to vary wildly when new observations become available. Therefore, it does not seem as if criticism (iii) has been met by the BCSO programme. Since this criticism is a vital one in the estimation of seasonal factors it does not seem clear, on a priori grounds, that the BCSO programme can be accepted. However, as opposed to this the BCSO takes account of the phenomenon of mixed seasonality. It is, therefore, necessary to go to the data and compare the results produced by the programmes to see which seasonal adjustment programme should be used. It is also necessary to go to the data to see if criticism (vii) of the XII applies to the unemployment data and also to see if the BCSO programme meets this criticism.

4.2.1. *Criteria as to which Method should be picked on a Model Free Basis*

It is assumed that any time series (Z) is made up of the three components — Trend Cycle (T), Seasonal (S) and Irregular (I). However, if the relationship between Z and T, S and I is not explicit, it is still possible to state what ideal characteristics one would expect of the estimated values of T, S and I. Using these ideals or criteria the empirical estimates of T, S and I produced by the XII and BCSO in the case of unemployment may be compared.

The following criteria have been picked from a practical point of producing a stable seasonality, both from the point of view of public confidence in that revisions of the seasonal factors should be minimal over time but, more importantly, seasonality is a phenomenon of stable between-year values. Therefore, the more movement there is in these values, the less there is of the phenomenon called seasonality. Below are widely accepted criteria as to what is to be expected of a seasonal adjustment technique — Granger (1976):

a) The trend cycle curve (T) should show no residual seasonality in the series;
b) T should be a fairly smooth curve with very little irregularity;
c) The movement in seasonality should be smooth and should not show high variation over the years;
d) The irregular series should show no remaining seasonality.

4.2.2. *Derivation of the Time Series Components of the Unemployment Data using the XII and the BCSO Seasonal Adjustment Methods*

As has been stated, the XII programme has the option of using an additive model or a multiplicative model. After several statistical tests, some of which were borrowed from the BCSO programme, it was decided that the additive model was more appropriate in the case of UB and UA while the multiplicative model was more appropriate in the case of UO. The F test for stable seasonality showed that the hypothesis of no stable seasonality could be rejected at the 99 per cent. level for all series.

There are two main programmes in the BCSO suite of programmes. The first programme is termed the BCSO test programme. This programme is used to determine the most likely model to fit the data.

The main statistic used in determining what model to use in the case of the BCSO adjustment (i.e. multiplicative, additive or mixed) is the F statistic. The following are the steps in the use of this statistic as outlined in Durbin and Murphy (1975).

i) Regress the deviations from trend $Y_{ij} = Z_{ij} - X_{ij}$ against the additive factors, i.e. $Y_{ij} = a_j + r_{ij}$.

ii) Then, regress the deviations from trend against both the additive and multiplicative $Y_{ij} = a_j + b_jX_{ij} + r_{ij}$. If the increase in the explained sum of squares (E.S.S.) when the multiplicative term is added is significant (Sm), then the multiplicative terms are regarded as necessary for satisfactory adjustment. (Non-significant additional multiplicative part is denoted at Nm.)

iii) Repeat the process initially with the multiplicative model $-Y_{ij} = b_jX_{ij} + r_{ij}$. Find the E.S.S. by introducing the additive term a_j to form the mixed model. If the increase is significant (S_a), then the additive term is regarded as necessary for satisfactory adjustment (Non-significant additional additive part is denoted by Na).

There are, therefore, four possible outcomes from which the following decision rule emerges:

a) NmNa — in this case either model could be used.
b) SaNm — only an additive model need be fitted.
c) SmNa — only the multiplicative term is needed.
D) SmSa — a mixed model is needed.

This, along with other statistics is used to pick the model.

In the case of the unemployment series UA and UB, the mixed model was most appropriate while the multiplicative model was found to be more appropriate for UO.

4.2.3. *Comparison of the XII and BCSO Methods of Seasonal Adjustment*

As was stated at the start of Section 3, it was necessary to determine if there was any difference between the results obtained from the different programmes. This is done first in this sub-section. The method of comparison used was that of regression analysis.

A regression analysis of the estimated components against each other was carried out (e.g., seasonal factor series for total unemployment estimated by the XII (LRXS) was regressed against the seasonal factor series for total unemployment estimated by the BCSO programme (LRBS)). Ideally, the slope coefficient should be 1 and the intercept zero. The results are set out in Table 1 below. As can be seen, in the case of seasonal series the slopes were significantly different to 1 — while the trend series seems to be similar in variation, the slopes showing no significant difference from 1.

TABLE 1: Regression Results

Regressor \ Regressent	LRBS		LRBT	
	Slope	T Value	Slope	T Value
LRXS	.959	2.1	..	..
LRXT	..	..	.999	.333

LRXS = seasonal factor series for total unemployment using the XII method
LRBS = „ „ „ „ „ „ „ „ BCSO method
LRXT = trend series for total unemployment using the XII method
LRBT = „ „ „ „ „ „ „ BCSO method

On the basis of the above, the differences between the series warrant a decision as to which method of seasonal adjustment might be best. Two different methods of analysis are used. First, an examination is made of the stability of the estimated seasonal factors and using the standard deviations of the factors over time and, second, the sample spectra are examined. The analysis in (a) below was carried out with the UA series while in (b) the aggregate series for unemployment (i.e., LR = UB + UA + UO) was used. Preliminary investigations show that similar results hold for all the components in the case of a).

(a) *Looking at the Variations in the Seasonal Factors*

The analysis in Table 2 was carried out, using the unemployment assistance series. If the table is examined, it can be seen that the range and the degree of random variation in the seasonal factors is much more pronounced in the case of the BCSO method of seasonal adjustment. This is borne out by the standard deviation. If stability of factors is to be a criterion, then the XII programme must be picked against the BCSO programme. It may be argued that the amplitude is changing all the time and that the local amplitude scaling factor is an improvement. However, it is contended that it is impossible to estimate the local amplitude with any degree of accuracy with fifteen observations and the BCSO estimate of the seasonal are, therefore, being too much influenced by the irregular.

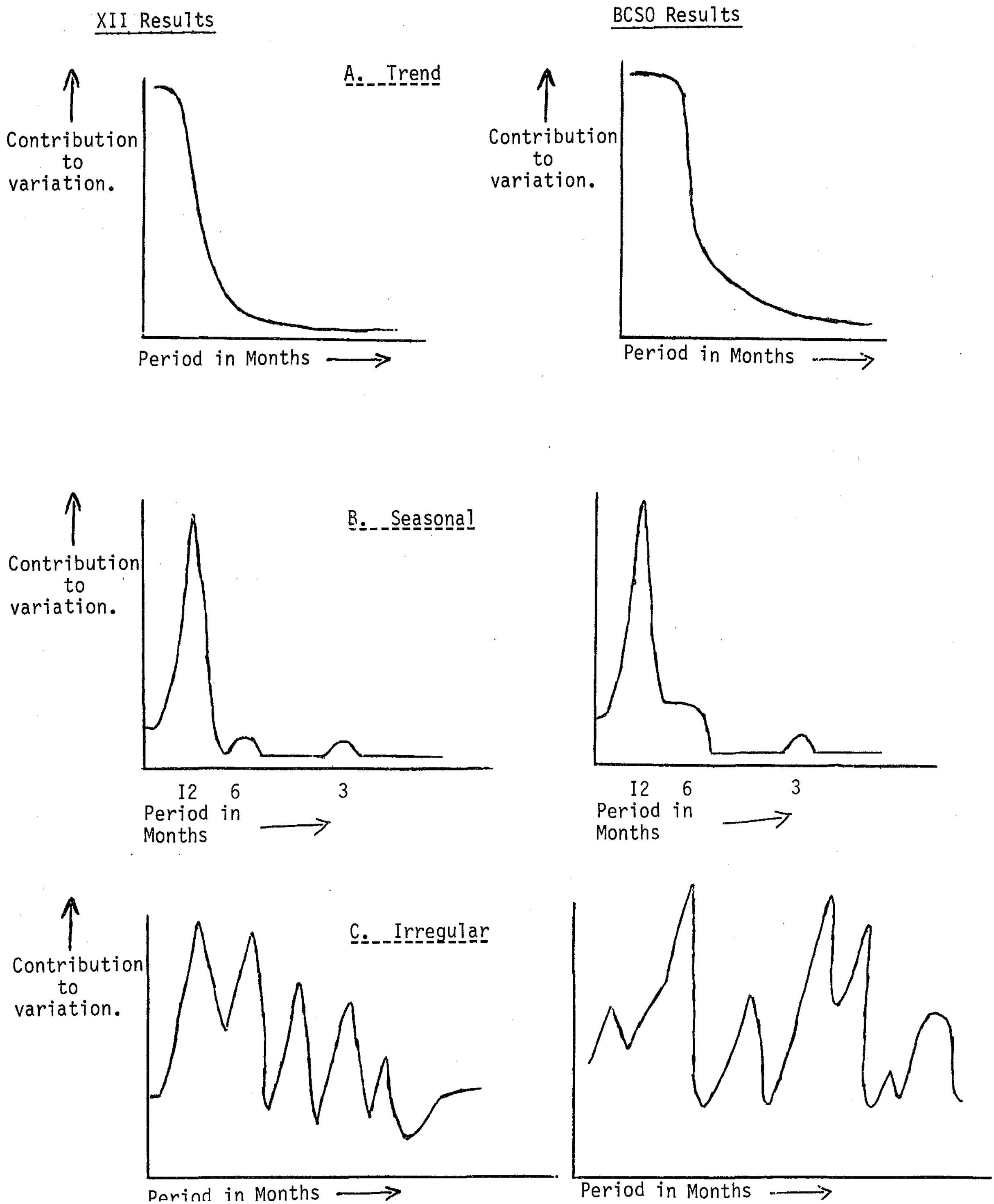
(b) *Looking at the Estimated Spectra of the Components of the Time Series Estimated under the Alternative Methods*

The estimated spectra of the time series components of LR are shown in figure 2 below.

TABLE 2 Estimates of Seasonal Components for 1977 for Unemployment Assistance (UA) using Progressively More Data

Seasonal Factor for Month / Estimated with Data from January 1967 to	January		February		March		April		May		June		July		August		September		October		November		December	
1977	X11	BSCO	X11	BCSO	X11	BCSO	X11	BCSO	X11	BCSO	X11	BCSO	X11	BCSO	X11	BCSO	X11	BCSO	X11	BCSO	X11	BCSO	X11	BCSO
December	941	648	1705	1336	1493	967	1043	414	399	+34	-844	-546	-1016	-610	-752	-313	-838	-186	-995	-577	-778	-474	-345	-135
1978																								
January	958	583	1803	1207	1592	1078	1042	582	303	-90	-852	-529	-1017	-559	-758	-396	-863	-311	-1026	-408	-802	-467	-362	-202
February	969	675	1772	1282	1575	736	1019	547	285	-36	-847	-717	-989	-689	-719	-375	-833	-322	-1026	-451	-817	-493	-371	-119
March	947	756	1729	1274	1606	719	1003	516	265	-4	-863	-669	-985	-647	-692	-379	-795	-294	-970	-518	-811	-387	-381	-150
April	948	683	1710	1141	1552	965	1021	462	245	-66	-874	-751	-993	-582	-686	-452	-773	-342	-968	-482	-785	-306	-369	-245
May	954	713	1715	1296	1544	774	1009	634	237	+232	-876	-637	-997	-638	-689	-403	-772	-304	-960	-661	-776	-761	-360	-479
Mean	953	676	1739	1256	1560	873	1023	526	289	12	-859	-64	-1000	-621	-716	-386	-812	-293	-991	-516	-795	-481	-365	-222
S.D.	13.2	58.7	39.6	70.2	40.4	149.4	16.6	80.0	59.2	116.6	13.8	89.7	13.8	47.1	32.5	45.3	37.8	55.0	66.3	91.4	39.2	153.8	27.2	134.4

S.D. = Standard Deviation.


XII Results
BCSO Results
A. Trend
Contribution to variation.
Period in Months
B. Seasonal
I2
6
3
Period in Months
C. Irregular
Contribution to variation.
Period in Months

The trend and the seasonal behave in both cases as they should, the trend only contributing to the variation of the series at the very low frequencies and the seasonal contributing to the variation of the series at the seasonal frequencies alone. Perhaps, the contribution of the BCSO seasonal at the six-month period is slightly more disparate than the XII programme.

When the spectra of the irregulars are examined, it can be seen that the XII seems to contain some variation due to the seasonal period of 12 months. However, when further investigated (by regressing the XII irregular estimate on itself lagged by 12 months), no significant autocorrelation of order twelve seems to be present.

In summary, then, the sample spectra indicate that the criteria are met equally by both methods. That is, the trends are smooth, the seasonal frequencies only are extracted by the seasonal adjustment method and there seems to be no residual seasonality left in the irregular series.

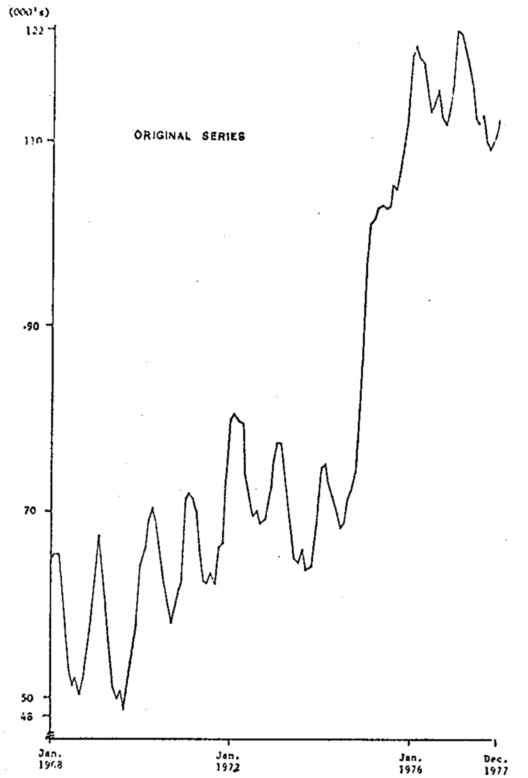
Since the spectral evidence cannot distinguish between the two series and since the instability of the seasonal factors is more pronounced in the case of the BCSO programme, it has been decided to continue using the XII programme. This is not the most satisfactory position and it is suggested that, if the 21-point and 15-point filters of the BCSO programme replaced the XII 12-point centred filter and the Spencer filter, then the XII programme could be improved and a lot of the criticism against it could be scotched.

Besides the moving average filter which are used to eliminate trend, the big difference between the British CSO programme and the XII is the method of dealing with moving seasonality. The BCSO method, first of all, assumes a rigid parameter structure and then changes this locally through the amplitude scaling factor. The XII programme, on the other hand, through its moving average of the month assumes a variable parameter model. It is felt by the authors that the latter position is the more satisfactory. However, very little work has been done in the selection of the optimal moving average filters across months in either programmes. It is felt that, if optimal filters were found, moving seasonality could be much more adequately dealt with by both programmes and the BCSO programme might show a marked improvement in performane. Until this is done, it is felt that the XII programme must continue to be used.

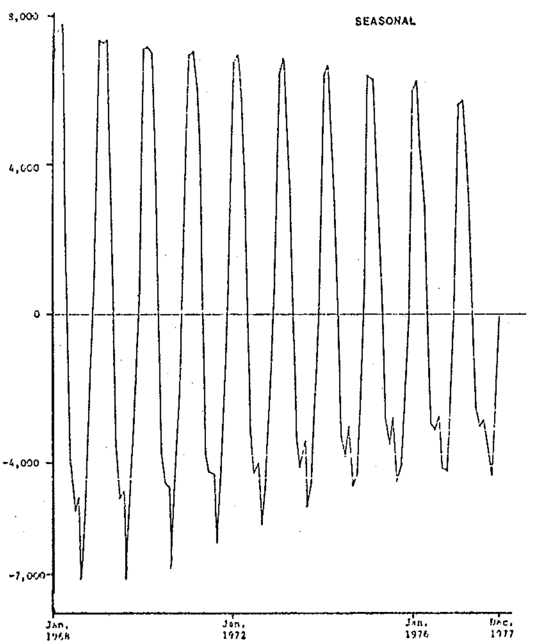
5. The Results of Seasonal Adjustment using the XII Programme

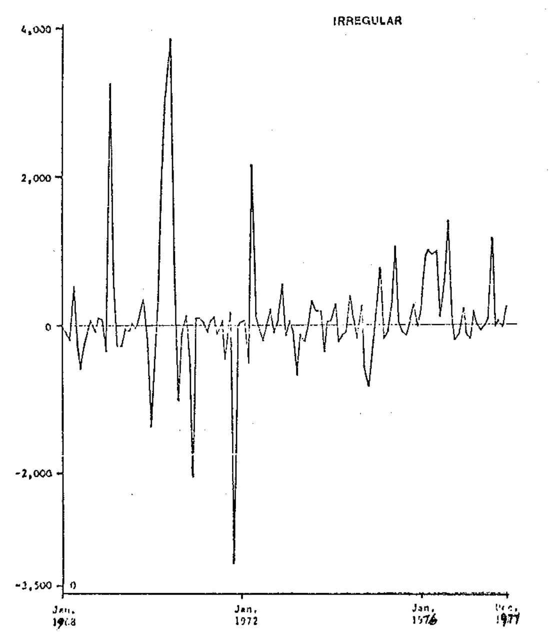
The three components of total unemployment (trend, seasonal and irregular) are shown in figure 3 below. These three components were estimated by adding together the estimated components of the individual series (UB, UA and UO) that make up total unemployment.

From 1969 to 1971 there was a trend upwards in unemployment which levelled off in 1972 and 1973 just before the oil crisis. There was then a


(000's)
ORIGINAL SERIES
122
110
90
70
50
48
Jan. 1968
Jan. 1972
Jan. 1976
Dec. 1977


(000's)
TREND CYCLE
116
100
80
60
54
Jan. 1968
Jan. 1972
Jan. 1976
Dec. 1977


SEASONAL
8,000
4,000
0
-4,000
-7,000
Jan. 1968
Jan. 1972
Jan. 1976
Dec. 1977


IRREGULAR
4,000
2,000
0
-2,000
-3,500
Jan. 1968
Jan. 1972
Jan. 1976
Dec. 1977

sharp movement upwards which did not slow down until the start of 1976. The deceleration continued through 1976 until it levelled off at the end of the year. Unemployment was falling slowly through 1977.

The amplitude seasonal factor has decreased consistently throughout the period of the study. As would be expected, unemployment in the first half of the year is seasonally high with the highest factors occurring in January and February. This factor continues to fall until July and then August shows a sudden increase in unemployment through the August holiday period. The downward movement in unempolyment then continues in September and October. Then there is a gradual rise in unemployment in November and December, somewhat alleviated by Christmas. Throughout the years, Christmas has become a much more important season for employment and overall, as has already been said, the amplitude or importance of seasonality has decreased.

Except for a few outliers at the start of the series, the irregular component plays a very small part in the series as a whole.

6. Conclusions

In attempting to derive the most satisfactory set of seasonal factors, this analysis has examined the data to be used, as well as the seasonal adjustment procedure.

It is contended that, if one figure is to be used as representative of the month, then average weekly data is most suitable. Regarding the choice between the BCSO and the XII programme, it has been decided to recommend the latter. This is not to imply that this method is perfect; indeed, it was tentatively suggested that it could be improved by the application of improved filtering techniques. Rather, the decision was based on the stability of the XII programme and the fact that the range and degree of random variation in the seasonal factors is more pronounced in the case of BCSO. This would suggest that the BCSO programme is too sensitive to the irregular component.

Summarising, this paper has examined two of the most sophisticated computer programmes available for the estimation of seasonal factors. Both the theoretical and empirical findings indicate that, given the present state of knowledge, the XII method should continue to be used.

Finally, it is recommended that average weekly data should be used as the raw data for the seasonal factor estimation routine. This would, of course, be at variance with the interdepartmental study group's suggestion that the present weekly live register statement be reduced to a monthly basis. Of course, our recommendation is being made on the basis of the unemployment series alone and, perhaps, the loss of information in this area could be more than made up for by the release of resources which could be used to collect more valuable statistics. However, if it were a decision as to which figure to take for a particular month, it may be better not to take an end-month figure as the interdepartmental study group recommend. As has been seen, the end-month figures can be influenced by unusual events like Christmas. A figure more representative of the month may be the mid-month figure which seems to vary much more in line with the average than the end-month figure does.

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